

Application No. 10/520,146
Response to Office Action dated April 22, 2008
Attorney Docket No. 4020-045767

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No. : 10/520,146
Applicant : Erling Lennart Hansen et al.
Filed : October 19, 2005
Title : Formaldehyde-Free Aqueous Binder Composition for Mineral
Fibers
Art Unit : 1796
Confirmation No. : 5566
Examiner : Liam J. Heincer
Customer No. : 28289

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
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DECLARATION UNDER 37 C.F.R. § 1.132

I, Erling Lennart Hansen, hereby declare as follows:

1. I am one of the named inventors of the invention described and claimed in the above-captioned application.

2. I have a M.Sc. in Chemical Engineering from Danmarks Tekniske Universitet, DTU. I have been employed by Rockwool International A/S for 21 years as Chemical Engineer/Department manager/Project Manager].

3. I am familiar with the subject matter of the above-identified application and have reviewed the rejection of claims 17-21 and 25-36 under 35 U.S.C. §102(b) as being anticipated by PCT Published Application No. WO 01/05725 to Hansen et al.; claims 17-21 and 25-36 under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,730,730 of Hansen et al.; and claims 22-24 under 35 U.S.C. §103(a) as being unpatentable

over WO 01/05725 as applied to claim 18 above, and further in view of Hummerich et al. (U.S. Patent No. 6,071,994) and the cited references.

4. Testing was performed under my direct supervision as follows:

Preparation of binder components A1 to A4

X g of diethanolamine (DEA) was placed in a 1-litre glass reactor provided with an agitator and a heating/ cooling jacket. The temperature of the diethanolamine was raised to 60°C whereafter Y1 grams of tetrahydrophthalic anhydride (THPA) was added. After raising the temperature to and keeping it at 130°C, a second portion Y2 of tetrahydrophthalic anhydride was added followed shortly by addition of Z grams of trimellitic anhydride (TMA).

After reaction for 1 hour, the mixture was cooled to 95°C, W gram of water added and the mixture is stirred for 1 hour. After further cooling of the reaction mixture to below 30°C, a binder component A was obtained having an equivalent ratio (NH+OH)/COOH as stated in the table below.

	A1	A2	A3	A4
(NH+OH)/ COOH	0,8	1.0	1,4	1.6
DEA (X)	158 g	158 g	158 g	158 g
THPA (Y1)	90 g	90 g	90 g	90 g
THPA (Y2)	161 g	115 g	38 g	24 g
TMA (Z)	144	115 g	86 g	86 g
Water (W)	304	263	210	197

Preparation of Binders Nos. 1-6

For the preparation of Binder Nos. 1-6 according the present invention, each of the binder components A1 to A4 was mixed with a binder component B which comprises glucose syrup according to the table below. For preparation of the final binder composition, to each of the compositions 1-6 was added a curing accelerator (2%, based on solids, of hypophosphorous acid), a coupling agent (3-aminopropyl-triethoxy silane) and ammonia. The

prepared mixtures were used to test the durability and curing behavior of the binders using the rod test and flash curing test, respectively.

Description of the rod test

Forty-five (45) ml of an aqueous solution of each of the binders obtained above, adjusted to 20% solids, was mixed with 450 g of shots. Out of the 225 g shot, 4 rods bars were made which were cured at 250°C for 2 hours. As shots was used non-fiberized fibre material with identical composition as the fibres. Shots with size between 0.25 and 0,5 mm diameter were used to make bars with dimensions 140 mm x 25 mm x 10 mm.

The durability of the binders was evaluated by measuring the 3-point bending strength of the rods. The results obtained are shown in the table below.

Description of flash curing test

Approx. 0.5 g of binder solution with a solids content of approx. 20% (determined by curing at 200°C for 1 hour) was evenly spread over a quartz filter (Grade QM-A, WHA 1851-047 from Bie & Berntsen).

The filter was placed in a hot air stream in a flash curing apparatus and cured at 250°C or 275°C for 4 minutes at a differential pressure over the filter of 190 mm water column. After curing, the filter was placed in a humidity chamber at 70°C and 95% RH.

The filter was weighed before application of binder, before and after curing in the flash curing apparatus and after 10 days exposure in the humid atmosphere. The amount of water absorbed can be determined from the above measurements.

Five filters of each binder to be tested were prepared, and the average result after 10 days of exposure for each binder was used as the test result.

Binder No.	Component A		Component B Glucose syrup	Amount of GS	(NH+OH) / COOH Incl.	Flash25 0°C 10days	Flash 275°C 10days	Rod test N/mm2
1	A1	100 g	18.9 g	25%	1.4	41 (7)*	29 (3)*	
2	A2	100 g	15.0 g	18%	1.4	46 (10)*	30 (7)*	
3	A3	100 g	0 g	0%	1.4	56 (8)*	43 (6)*	
4	A2	100 g	20.8 g	25%	1.6	38 (4)*	36 (4)*	5.3 (0.8)*
5	A4	100 g	0 g	0%	1,6	-	-	4.1 (0.9)*
6	A1	100 g	0 g	0%	0.8	-	-	4.4 (0.1)*

**Figures in the brackets are the standard deviation*

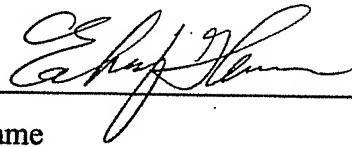
In the so-called "Rod test", it was shown that the binder according to the present invention containing binder components (A) and (B) surprisingly provided a significantly higher 3-point bending strength (5.3 N/mm²) compared to a binder component (A) alone (4.1 N/mm²) having the same [NH+OH/COOH] ratio (1.6), thus demonstrating improved durability.

In the so-called "Flash curing test", it was shown that the binders according to the present invention containing binder components (A) and (B) surprisingly exhibited far lower moisture take-up after curing at a curing temperature of 250°C than a comparative binder not containing a carbohydrate (B) within the claimed equivalent ranges. Furthermore, the moisture take-up at 250°C of the binders containing the carbohydrate is of the same magnitude as the moisture take-up at 275°C of the comparative binder not containing a carbohydrate (B), demonstrating a better curing behavior of the binders containing the carbohydrate.

This allows working at lower curing temperatures with reduced thermal decomposition of the bonded mineral wool products.

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I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.


Name

17 October 2008
Date